HORIBA
Semiconductor

STEC Fluid Control
Technology

High Performance Mass Flow Controller

SEC-Z500X

Introducing the remarkable X,
a break-through in mass flow control technology

The mass flow controller, is a key piece of semiconductor manufacturing equipment.

Its quality and efficiency play a major role in the success or failure of the semiconductor manufacturing process.

HORIBA STEC, a company that has consistently introduced high-quality, highly functional products

to the demanding semiconductor manufacturing market,

and thereby grown its worldwide market share to over 30%*[1], has recently developed a new mass flow controller,

one that breaks the mold completely and will change the future of mass flow control technology.

That new mass flow controller is the SEC-Z500X.

It provides all the mass flow functions customers need, including the flexibility to handle different gas types and flow volumes.

The customer him or herself can alter its specifications to suit changing needs*[2].

The unit is also RoHS compliant, which makes it the perfect environmentally friendly tool for improving corporate value.

The highly functional, high added value 'X' is brimming with previously unknown charm.

The world is witnessing the birth of a mass flow controller that will change the future of the semiconductor industry.

SEC-Z500X, revealed for the first time

*[1] From HORIBA STEC's 2012 research.
*[2] Multi-gas, multi-range function

Quality and dependability

The superior dependability you expect from HORIBA STEC. Industry leader

HORIBA STEC, is a brand hailed by equipment manufacturers throughout the world, one of many indications that HORIBA STEC consistently supplies high-quality, highly dependable products that meet the toughest standards.

Reliable supply

HORIBA STEC quickly and reliably supplies equipment to its customers through its three main bases: Kyoto, which acts as HORIBA STEC's headquarters; Aso, the HORIBA Group's mass production factory, which features the latest in production equipment; and two bases in the United States (CA, TX), which act as ultra-quick suppliers.

* The new Aso factory was completed in October 2005.

Global support

A reliable support system with an international network

Using a network that has branches throughout the world, HORIBA STEC's highly skilled engineers offer complete support for all HORIBA STEC products.

RoHS compliant

Complying with all RoHS regulations

The Corporate Social Responsibility (CSR) of companies involves, among other things, working to protect the environment. As a company within the HORIBA Group, a leader in environmental analysis equipment, HORIBA STEC is always striving to develop and manufacture environmentally sound products.

RoHS regulations:
RoHS stands for "Restriction of Hazardous Substances" and is a set of regulations enforced in the EU to limit the use of six hazardous substances (lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyls ether (PBDE)), in electric and electronic components.

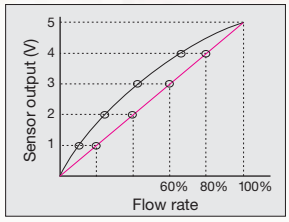
High Accuracy

High accuracy

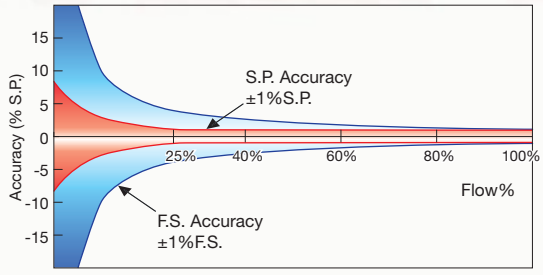
High accuracy ±1.0% S.P.

MFC's linearity is compensated by polynomial approximated curve. This achieves high accuracy for all flow control ranges. For the purpose of advancement of actual gas accuracy, the calibration data of various process gases are measured by HORIBA STEC standard gas measurement system.

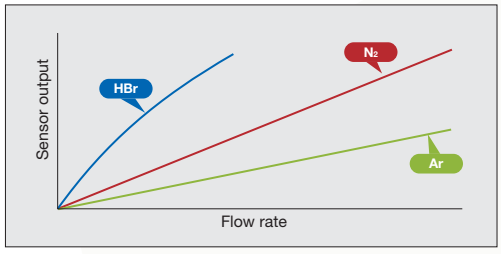
Accuracy	±1.0% S.P.	: 25–100% F.S.
	±0.25% F.S.	: ≤25% F.S.



$y=ax^5+bx^4+cx^3+dx^2+ex+f$



Gas flow rate characteristic curve



Gases used in semiconductor processes have a variety of different properties. The flow rate calibration function used in the SEC-Z500X series uses detailed measurement data about the flow rate characteristics of each type of process gas, across different flow rate ranges, as a basis for calibration. This huge store of measurement data paired with highly reliable sensors and the latest in calibration technology ensures extremely precise process gas flow rate control.

Traceability

The National Institute of Standards and Technology (NIST, a U.S. organization) certifies the traceability of the flow rate calibration used by the SEC-Z500X series. These units use a flow rate calibration unit that meets NIST calibration standards.

National Institute of Standards and Technology (NIST)

↓

Standard flow rate unit: Designed and created by HORIBA STEC

↓

SEC-Z500X series

High-precision standard flow rate system

The latest high-precision standard flow rate system is installed at HORIBA STEC's bases in the United States and Japan. This system, which uses a build-up method, can measure the flow rate of process gases, including those containing a high level of toxic substances, and volatile gases. The measured data is centrally managed through a database maintained at headquarters, which allows HORIBA STEC to continually improve process gas flow rate control precision.

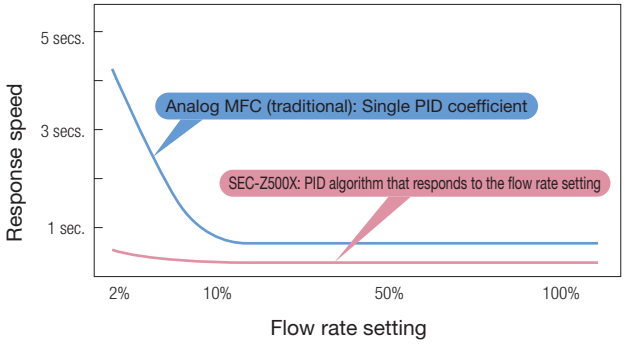
We never compromise on performance.

High-speed response throughout the flow rate range

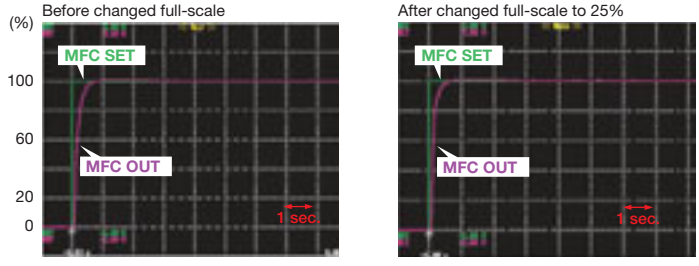
High speed response

SEC-Z500X is installed with a newly developed "Variable PID system", which can achieve 1 second response to all setting points. Variable PID is continuously changing depending on
setting flow points. This allows the PID factor to be optimized when you change full scale flow and gase.

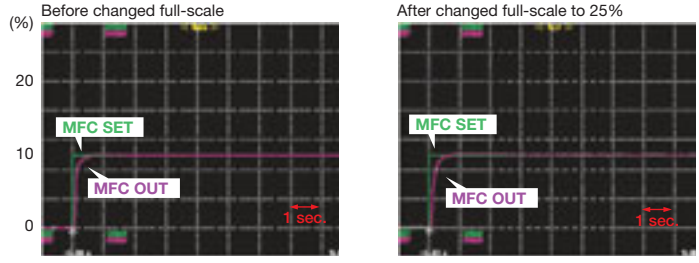
Response speed comparison, with and without the PID algorithm



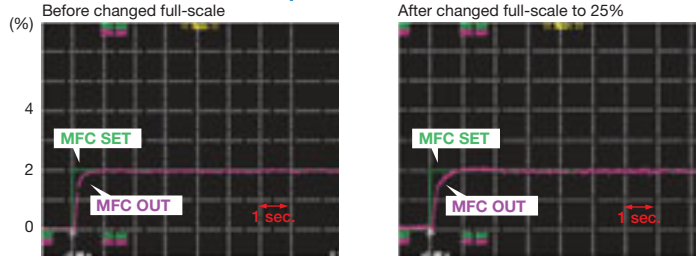
SEC-Z500X 0 → 100% F.S. response characteristics



SEC-Z500X 0 → 10% F.S. response characteristics



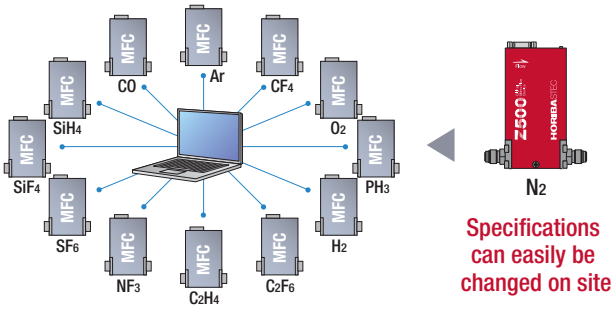
SEC-Z500X 0 → 2% F.S. response characteristics



The best in quality for you

Multi-gas, multi-range solution

HORIBA STEC has made it possible for the user to change the type of gas or full-scale flow rate on site. Our special Z500 configuration software makes it possible to change these specifications at will. Best of all, the changes can be made without removing the mass flow controller from the gas panel or piping. This reduces the number of spare mass flow controllers users need to store, and helps save both time and money.



Suitable for multiple types of gas

Freely change types of gas

Example: SEC-Z500X MR.MG-02 — N_2 100 SCCM ▶ Ar 110 SCCM, B_2H_6 55 SCCM

Suitable for multiple ranges

Freely change the full scale

Example: SEC-Z500X MR.MG-04 — N_2 1000 SCCM (Flow rate control range 20 to 1000 SCCM) ▶ N_2 250 SCCM (Flow rate control range 5 to 250 SCCM)

Changing the full-scale flow rate

Even when the same full-scale values are used, the MR/MG numbers associated with the full-scale flow rate values for the calibration gas may vary, due to variations in the thermal conductivity of the different process gases. To increase flow rate calibration precision, HORIBA STEC offers the following lineup of MR/MG numbers.

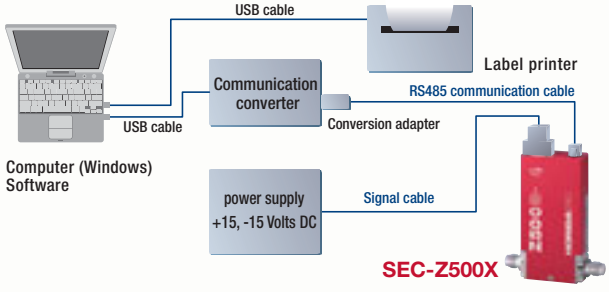
List of full-scale flow rates for different gases

Gas type / MR/MG number	N_2	Ar	H_2	SF_6	HBr	WF_6
SEC-Z51_X series						
R01	3 – 10	4 – 11	3 – 10	1 – 3	—	—
R1.5					—	—
01	8 – 30	11 – 35	8 – 30	3 – 11	5 – 9	—
1.5					9 – 17	—
02	25 – 100	35 – 110	25 – 100	9 – 36	15 – 28	5 – 6
2.5					25 – 50	6 – 11
03	75 – 300	110 – 350	75 – 300	28 – 100	44 – 86	11 – 20
3.5					79 – 150	19 – 37
04	250 – 1000	350 – 1100	250 – 1000	90 – 350	150 – 280	34 – 67
4.5					280 – 540	60 – 110
05	750 – 3000	1100 – 3500	750 – 3000	260 – 1000	470 – 930	110 – 200
5.5					910 – 1800	200 – 380
06	2500 – 10000	3500 – 11000	2500 – 10000	780 – 3100	1700 – 3300	360 – 700
SEC-Z52_X series						
6.5					2800 – 9000	—
07	10000 – 30000	10000 – 30000	10000 – 30000	2700 – 7800	9000 – 17000	—
08	30000 – 50000	30000 – 50000	30000 – 50000	7800 – 13000	15000 – 29000	—

Minimum flow rate — maximum flow rate
Unit : SCCM

Configuration software that allows the user to alter specifications on-site

The SEC-Z500X offers multi-gas, multi-range functionality, thanks to its configuration software. This software makes it possible to select MR/MG numbers simply by entering the type of gas being used and the flow rate range, and also features a handy N2 gas conversion feature for flow rate measurements using N2 gas during receipt inspections. To ensure that the software is used without error, HORIBA STEC offers software operation trainings. For information on these trainings, please contact your HORIBA STEC representative.



Name	Notes
Computer	OS: Japanese or English, Windows® 2000 / XP / Vista / 7 / 8
Software	Configuration software HORIBA STEC offers trainings detailing the use of the software.
Communications converter (serial)	RS-485 Please consult your HORIBA STEC representative for further information
Conversion adapter	Dedicated adapter CA-EDP9RJ45
RS485 communication cable	Dedicated cable SC-EBR
USB cable	Cable for label printer and communication converter
Label printer	Please consult your HORIBA STEC representative for further information

The customer can supply all the system components listed above, if desired, except for the software, which must be provided by HORIBA STEC. Please consult your HORIBA STEC representative for more detailed specifications.

Product specifications

▶ Digital/Analog communication models

Mass flow controller model *1	SEC-Z512KX	SEC-Z512MGX SEC-Z512X	SEC-Z522MGXN SEC-Z522XN	SEC-Z522MGX SEC-Z522X
Mass flow meter model *1	SEF-Z512KX	SEF-Z512MGX SEF-Z512X	SEF-Z522MGXN SEF-Z522XN	SEF-Z522MGX SEF-Z522X
Full-scale flow rate (N_2 conversion flow rate)	1/2 SCCM	MR/MG number #R01: 10 SCCM #R1.5: 17.5 SCCM #01: 30 SCCM #1.5: 55 SCCM #02: 100 SCCM #2.5: 175 SCCM #03: 300 SCCM #3.5: 550 SCCM #04: 1 SLM #4.5: 1.75 SLM #05: 3 SLM #5.5: 5.5 SLM #06: 10 SLM	MR/MG number #6.5: 22 SLM #07: 30 SLM #08: 50 SLM	
Valve Type	O: Normally open C: Normally close			
Flow rate at fully closed control valve	≤ 2% F.S.			
Flow rate control range	2-100% of F.S.			
Flow rate measuring range (SEF)	0-100% of F.S.			
Accuracy *2	±1.0% F.S.	±1.0% S.P. (Flow rate > 25% F.S.) ±0.25% F.S. (Flow rate ≤ 25% F.S.)		
Operating temperature	5 to 50°C (recommended temperature range: 15 to 45°C)			
Response	≤ 1 second: over full flow rate range			
Linearity	≤ ±0.5% F.S.			
Repeatability	≤ ±0.2% F.S.			
Operating differential pressure	50 to 300 kPa (d)	50 to 300 kPa (d) #5.5, #06: 100 to 300 kPa (d)	200 to 300 kPa (d)	
Operating differential pressure (SEF)	≤ 300 kPa (d)			
MAX. Operating pressure	450 kPa (g)			
Pressure resistance	1000 kPa (g)			
Leak Integrity	≤ 5 x 10^{-12} Pa•m^3/s (He)			
Flow rate setting signal	0.1 to 5 V DC (2% to F.S.): input impedance 1 MΩ or higher			
Flow rate output signal	0 to 5 V DC (0% to F.S.): minimum load resistance 2 kΩ or higher			
Digital interface	With address function: RS-485 (transmission speed 38,400 bps) F-Net Protocol			
Wetted materials	316L Stainless Steel (polished surface)			
Power supply	+15 V ±5% 150 mA -15 V ±5% 150 mA			
Signal response	Analog: D-Sub 9-pin (TOP) Digital: 2 LAN jacks (TOP)			
Standard Fitting *3	1/4 inch VCR equivalent Option: 1.125 inch IGS, 1.5 inch IGS		1/4 inch VCR equivalent Option: 1.125 inch IGS	1.5 inch IGS
Mounting orientation	Free			

*1 The gas type and full scale settings for the SEC(SEF)-Z512MGX, Z522MGX, Z522MGXN, Z532MGX, Z542MGX, Z552MGX and Z562MGX can be changed by the operator, using special software.
*2 The precision is that associated with the full-scale MR and MG number values. The flow rate precision guaranteed temperatures conform to SEMI standards. For details, please contact HORIBA STEC.
*3 IGS: Integrated Gas System
● SCCM and SLM are notations indicating the gas flow rate (mL/min, L/min, at 0°C and 101.3 kPa).

▶ DeviceNet™ communication models

ODVA CONFORMANT

Mass flow controller model *1	SEC-Z514KX	SEC-Z514MGX	SEC-Z524MGXN	SEC-Z524MGX
Mass flow meter model *1	SEF-Z514KX	SEF-Z514MGX	SEF-Z524MGXN	SEF-Z524MGX
Full-scale flow rate (N_2 conversion flow rate)	1/2 SCCM	MR/MG number #R01: 10 SCCM #R1.5: 17.5 SCCM #01: 30 SCCM #1.5: 55 SCCM #02: 100 SCCM #2.5: 175 SCCM #03: 300 SCCM #3.5: 550 SCCM #04: 1 SLM #4.5: 1.75 SLM #05: 3 SLM #5.5: 5.5 SLM #06: 10 SLM	MR/MG number #6.5: 22 SLM #07: 30 SLM #08: 50 SLM	
Valve Type	O: Normally open C: Normally close			
Flow rate at fully closed control valve	≤ 2% F.S.			
Flow rate control range	2-100% of F.S.			
Flow rate measuring range (SEF)	0-100% of F.S.			
Accuracy *2	±1.0% F.S.	±1.0% S.P. (Flow rate > 25% F.S.) ±0.25% F.S. (Flow rate ≤ 25% F.S.)		
Operating temperature	5 to 50°C (recommended temperature range: 15 to 45°C)			
Response	≤ 1 second: over full flow rate range			
Linearity	≤ ±0.5% F.S.			
Repeatability	≤ ±0.2% F.S.			
Operating differential pressure	50 to 300 kPa (d)	50 to 300 kPa (d) #5.5, #06: 100 to 300 kPa (d)	200 to 300 kPa (d)	
Operating differential pressure (SEF)	≤ 300 kPa (d)			
MAX. Operating pressure	450 kPa(g)			
Pressure resistance	1000 kPa(g)			
Leak Integrity	≤ 5 x 10^{-12} Pa•m^3/s (He)			
Digital interface	DeviceNet™ Protocol			
Wetted materials	316L Stainless Steel (polished surface)			
Power supply	Conforming to ODVA standards, DC 24 V, 4.0 VA			
Standard Fitting *3	1/4 inch VCR equivalent Option: 1.125 inch IGS, 1.5 inch IGS		1/4 inch VCR equivalent Option: 1.125 inch IGS	1.5 inch IGS
Mounting orientation	Free			

*1 The gas type and full scale settings for the SEC(SEF)-Z514MGX, Z524MGX, Z524MGXN, Z534MGX, Z544MGX, Z554MGX and Z564MGX can be changed by the operator, using special software.
*2 The precision is that associated with the full-scale MR and MG number values. The flow rate precision guaranteed temperatures conform to SEMI standards. For details, please contact HORIBA STEC.
*3 IGS: Integrated Gas System
● SCCM and SLM are notations indicating the gas flow rate (mL/min, L/min, at 0°C and 101.3 kPa).

SEC-Z532MGX	SEC-Z542MGX	SEC-Z552MGX	SEC-Z562MGX	Mass flow controller model *1
SEF-Z532MGXN	SEF-Z542MGXN	SEF-Z552MGX	SEF-Z562MGX	Mass flow meter model *1
MR/MG number #09: 100 SLM	MR/MG number #10: 200 SLM	MR/MG number #11: 300 SLM	MR/MG number #12: 500 SLM	Full-scale flow rate (N_2 conversion flow rate)
O: Normally open C: Normally close		C: Normally close		Valve Type
≤ 2% F.S.				Flow rate at fully closed control valve
2-100% of F.S.				Flow rate control range
0-100% of F.S.				Flow rate measuring range (SEF)
±1.0% S.P. (flow rate > 35% F.S.) ±0.35% F.S. (flow rate ≤ 35% F.S.)		±2% S.P. (flow rate > 50% F.S.) ±1% F.S. (flow rate ≤ 50% F.S.)		Accuracy *2
5 to 50°C (recommended temperature range: 15 to 45°C)				Operating temperature
≤ 1 second: over full flow rate range		≤ 2 second: over full flow rate range		Response
≤ ±0.5% F.S.		±1% F.S.		Linearity
≤ ±0.2% F.S.		±0.5% F.S.		Repeatability
100 to 300 kPa (d)	200 to 300 kPa (d)	150 to 350 kPa (d)	250 to 350 kPa (d)	Operating differential pressure
≤ 300 kPa (d)		≤ 300 kPa (d)		Operating differential pressure (SEF)
450 kPa (g)				MAX. Operating pressure
1000 kPa (g)				Pressure resistance
≤ 5 x 10^{-12} Pa•m^3/s (He)				Leak Integrity
0.1 to 5 V DC (2% to F.S.): input impedance 1 MΩ or higher				Flow rate setting signal
0 to 5 V DC (0% to F.S.): minimum load resistance 2 kΩ or higher				Flow rate output signal
With address function: RS-485 (transmission speed 38,400 bps) F-Net Protocol		With address function: RS-495 (transmission speed 38,400 bps) F-Net Protocol		Digital interface
316L Stainless Steel (polished surface)				Wetted materials
+15 V ±5% 150 mA -15 V ±5% 150 mA		+15 V 150 mA -15 ±5% 150 mA		Power supply
Analog: D-Sub 9-pin (TOP) Digital: 2 LAN jacks (TOP)		Analog: D-Sub 9-pin (TOP, SIDE) Digital: 2 LAN jacks (TOP)		Signal response
1/2 inch VCR equivalent Option: 1. 5 inch IGS		1/2 inch VCR equivalent		Standard Fitting *3
Free				Mounting orientation

SEC-Z534MGX	SEC-Z544MGX	SEC-Z554MGX	SEC-Z564MGX	Mass flow controller model *1
SEF-Z534MGXN	SEF-Z544MGXN	SEF-Z554MGX	SEF-Z564MGX	Mass flow meter model *1
MR/MG number #09: 100 SLM	MR/MG number #10: 200 SLM	MR/MG number #11: 300 SLM	MR/MG number #12: 500 SLM	Full-scale flow rate (N_2 conversion flow rate)
O: Normally open C: Normally close		C: Normally close		Valve Type
≤ 2% F.S.				Flow rate at fully closed control valve
2-100% of F.S.				Flow rate control range
0-100% of F.S.				Flow rate measuring range (SEF)
±1.0% S.P. (Flow rate > 35% F.S.) ±0.35% F.S. (Flow rate ≤ 35% F.S.)		±2% S.P. (flow rate > 50% F.S.) ±1% F.S. (flow rate ≤ 50% F.S.)		Accuracy *2
5 to 50°C (recommended temperature range: 15 to 45°C)				Operating temperature
≤ 1 second: over full flow rate range		≤ 2 second: over full flow rate range		Response
≤ ±0.5% F.S.		±1% F.S.		Linearity
≤ ±0.2% F.S.		±0.5% F.S.		Repeatability
100 to 300 kPa (d)	200 to 300 kPa (d)	150 to 350 kPa (d)	250 to 350 kPa (d)	Operating differential pressure
≤ 300 kPa (d)		≤ 300 kPa (d)		Operating differential pressure (SEF)
450 kPa(g)				MAX. Operating pressure
1000 kPa(g)				Pressure resistance
≤ 5 x 10^{-12} Pa•m^3/s (He)				Leak Integrity
DeviceNet™ Protocol				Digital interface
316L Stainless Steel (polished surface)				Wetted materials
Conforming to ODVA standards, DC 24 V, 4.0 VA		Conforming to ODVA standards,DC 24 V, 4.0 VA		Power supply
1/2 inch VCR equivalent Option: 1. 5 inch IGS		1/2 inch VCR equivalent		Standard Fitting *3
Free				Mounting orientation

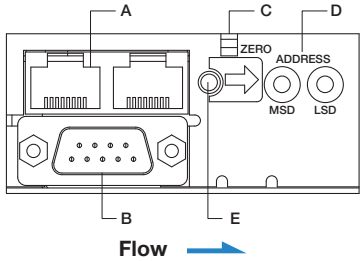
Product specifications

▶ EtherCAT® communication model

Mass flow controller model *1	SEC-Z517KX	SEC-Z517MGX	SEC-Z527MGXN	SEC-Z527MGX
Mass flow meter model *1	SEF-Z517KX	SEF-Z517MGX	SEF-Z527MGXN	SEF-Z527MGX
Full-scale flow rate (N_2 conversion flow rate)	1/2 SCCM	MR/MG number #R1.5: 17.5 SCCM #1.5: 55 SCCM #2.5: 175 SCCM #3.5: 550 SCCM #4.5: 1.75 SLM #5.5: 5.5 SLM #R01: 10 SCCM #01: 30 SCCM #02: 100 SCCM #03: 300 SCCM #04: 1 SLM #05: 3 SLM #06: 10 SLM	MR/MG number #6.5: 22 SLM #07: 30 SLM #08: 50 SLM	
Valve Type	O: Normally open C: Normally close			
Flow rate at fully closed control valve	≤ 2% F.S.			
Flow rate control range	2-100% of F.S.			
Flow rate measuring range (SEF)	0-100% of F.S.			
Accuracy *2	±1.0% F.S.	±1.0% S.P. (Flow rate > 25% F.S.) ±0.25% F.S. (Flow rate ≤ 25% F.S.)		
Operating temperature	5 to 50°C (recommended temperature range: 15 to 45°C)			
Response	≤ 1 second: over full flow rate range			
Linearity	≤ ±0.5% F.S.			
Repeatability	≤ ±0.2% F.S.			
Operating differential pressure	50 to 300 kPa (d)	50 to 300 kPa (d) #5.5, #06: 100 to 300 kPa (d)	200 to 300 kPa (d)	
Operating differential pressure (SEF)	≤ 300 kPa (d)			
MAX. Operating pressure	450 kPa(g)			
Pressure resistance	1000 kPa(g)			
Leak Integrity	≤ 5 x 10^{-12} Pa•m^3/s (He)			
Digital interface	EtherCAT® Protocol			
Wetted materials	316L Stainless Steel (polished surface)			
Power supply	DC 24 V, 6.8 VA			
Standard Fitting *3	1/4 inch VCR equivalent Option: 1.125 inch IGS		1/4 inch VCR equivalent Option: 1.125 inch IGS	
Mounting orientation	Free			

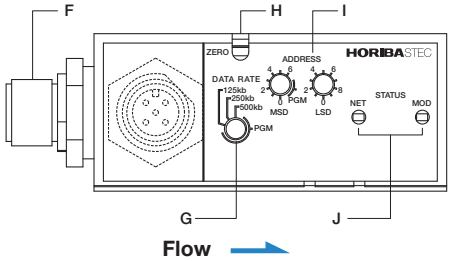
*1 The gas type and full scale settings for the SEC(SEF)-Z517MGX, Z527MGX, Z527MGXN, Z537MGX, Z547MGX, Z557MGX and Z567MGX can be changed by the operator, using special software.
*2 The precision is that associated with the full-scale MR and MG number values. The flow rate precision guaranteed temperatures conform to SEMI standards. For details, please contact HORIBA STEC.
*3 IGS: Integrated Gas System
● SCCM and SLM are notations indicating the gas flow rate (mL/min, L/min, at 0°C and 101.3 kPa).

▶ Digital/Analog communication models



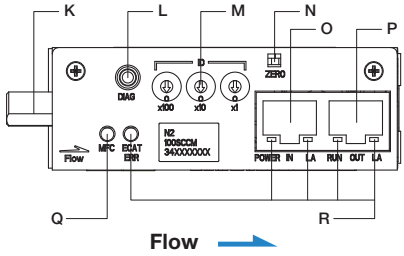
Symbol	Name	Explanation
A	Connector for digital transmission	RS-485 transmission Daisy chain available
B	Analog connector	Analog transmission and power supply
C	ZERO adjust switch	Switch for zero adjust
D	Address switch	Set from 0 x 01 to 0 x 99 (Not available from 0 x △A to △F)
E	LED indicator	Analog transmission: Green right on Digital transmission : Green right flashing * Red right on when alarming and zero offset error

▶ DeviceNet™ communication models



Symbol	Name	Explanation
F	DeviceNet™ connector	DeviceNet™ transmission and shield type micro connector
G	Baud rate setting switch	Set baud rate
H	ZERO adjust switch	Switch for zero adjust
I	MAC ID setting switch	Set from 00 to 63
J	LED Indicator	NET :Status for network MOD :Status for node

▶ EtherCAT® communication model



Symbol	Name	Explanation
K	Power connector	Drive power supply connector
L	DIAG communication port	Service communication port
M	EtherCAT® ID selector	Settable in a range from 0x0000 to 0x0FFF * If this ID is used for EtherCAT® communication, it is required to perform a predetermined initial setting. If you have any question about how to set up, please contact us.
N	ZERO adjust switch	Zero adjust switch
O	EtherCAT® IN port	For EtherCAT® communication. Connection on IN side
P	EtherCAT® OUT port	For EtherCAT® communication. Connection on OUT side
Q	MFC indicator LED	Indicates MFC state. Normal: Turns on in green Abnormal: Turns on in red or flashes in red/green depending on abnormal cause.
R	EtherCAT® indicator LED	ECAT ERR: Indicates error state of EtherCAT® communication. POWER: Turns on in green when power is supplied. LA: Indicates link/active state of each port. RUN: Indicates state of EtherCAT® state machine.

SEC-Z537MGX	SEC-Z547MGX	SEC-Z557MGX	SEC-Z567MGX	Mass flow controller model *1
SEF-Z537MGXN	SEF-Z547MGXN	SEF-Z557MGX	SEF-Z567MGX	Mass flow meter model *1
MR/MG number #09: 100 SLM	MR/MG number #10: 200 SLM	MR/MG number #11: 300 SLM	MR/MG number #12: 500 SLM	Full-scale flow rate (N_2 conversion flow rate)
O: Normally open C: Normally close		C: Normally close		Valve Type
≤ 2% F.S.				Flow rate at fully closed control valve
2-100% of F.S.				Flow rate control range
0-100% of F.S.				Flow rate measuring range (SEF)
±1.0% S.P. (Flow rate > 35% F.S.) ±0.35% F.S. (Flow rate ≤ 35% F.S.)		±2% S.P. (flow rate > 50% F.S.) ±1% F.S. (flow rate ≤ 50% F.S.)		Accuracy *2
5 to 50°C (recommended temperature range: 15 to 45°C)				Operating temperature
≤ 1 second: over full flow rate range		≤ 2 second: over full flow rate range		Response
≤ ±0.5% F.S.		±1% F.S.		Linearity
≤ ±0.2% F.S.		±0.5% F.S.		Repeatability
100 to 300 kPa (d)	200 to 300 kPa (d)	150 to 350 kPa (d)	250 to 350 kPa (d)	Operating differential pressure
≤ 300 kPa (d)		≤ 300 kPa (d)		Operating differential pressure (SEF)
450 kPa(g)				MAX. Operating pressure
1000 kPa(g)				Pressure resistance
≤ 5 x 10^{-12} Pa•m^3/s (He)				Leak Integrity
EtherCAT® Protocol				Digital interface
316L Stainless Steel (polished surface)				Wetted materials
DC 24 V, 6.8 VA				Power supply
1/2 inch VCR equivalent Option: 1. 5 inch IGS		1/2 inch VCR equivalent		Standard Fitting *3
Free				Mounting orientation

Selecting a model

❶Model
SEC-Z5: Mass Flow Controller
SEF-Z5: Mass Flow Mater

❷Full-scale flow rate
1: 10 SLM (N2 equivalent flow rate)
2: 50 SLM (N2 equivalent flow rate)
3: 100 SLM (N2 equivalent flow rate)
4: 200 SLM (N2 equivalent flow rate)
5: 300 SLM (N2 equivalent flow rate)
6: 500 SLM (N2 equivalent flow rate)
* Full-scale flow rate of SEC-Z512KX is 1/2 SCCM (N2 equivalent flow rate).

❸Communication mode
2: Digital communication, Analog communication
4: DeviceNet™ communication
7: EtherCAT® communication

❹Valve type
O: Normally open
C: Normally close

❺Connector position
With Digital•Analog "T"
With DeviceNet™ only, select "S" or "T".
T: Top of case
S: Side of case
With EtherCAT® "S"

❻Number of calibration curves
1: Standard (Digital•Analog, DeviceNet™)
5: EtherCAT®

❼DeviceNet™ output range
Blank: Not a DeviceNet™ model
1: Full-scale flow rate output 100% F.S. (compatible with SEC-Z5_4MGX)
3: Full-scale flow rate output 133% F.S. (compatible with SEC-Z5_4MGX)
5: Full-scale flow rate output 133.329% F.S. (compatible with SEC-Z5_4MGX)

❶	❷	❸		❹	❺	❻	❼	❽	❾	❿	⓫	⓬	⓭
SEC-Z5	1	2	MGX	O	T	1	—	MR.MG-02	100SCCM	4CR	B	SUC	N2

❽MR/MG numbers
Please specify MR/MG numbers. For details, please see the specifications.

❾Full-scale flow rate

❿Joint
4CR: 1/4 inch VCR male type fitting
8CR: 1/2 inch VCR male type fitting
14C: 1.125 inch C-seal, i.d. 1/4 inch
14W: 1.125 inch W-seal, i.d. 1/4 inch
24W: 1.5 inch, W-seal, i.d. 1/4 inch
24S: 1.5 inch, CS-seal, i.d. 1/4 inch
24B: 1.5 inch, B-seal, i.d. 1/4 inch

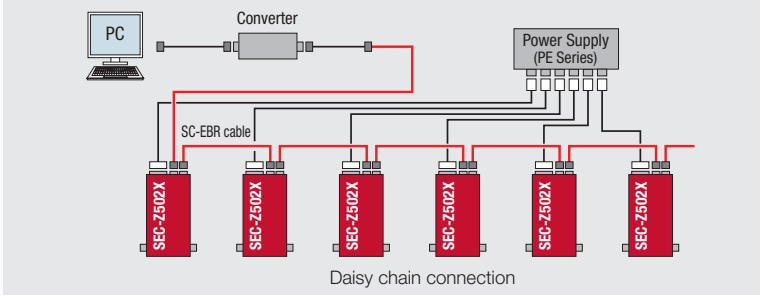
⓫Distance between joints
B : 106 mm J : 150.4 mm
E : 156 mm L : 124 mm
G : 177 mm S : 132 mm
IGS joint distance between down ports
2 : 79.8 mm
3 : 92 mm
5 : 96 mm

⓬Internal surface polish
SUC: Standard for all models *
* No. necessary to enter "Polished surface" when your ordering.

⓭Types of gas
Blank: Type of gas is not specified by MR/MG compatibility Gas name

Connector examples

Digital communication



Daisy chain connection

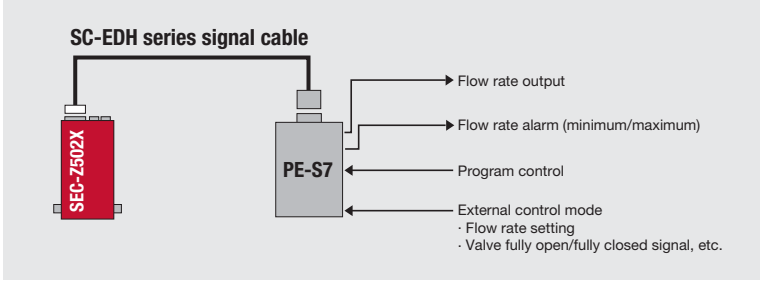
RS485 digital communication connector

Pin No.	Signal name
1	Signal ground [D. COM]
2	Signal ground [D. COM]
3	N.C.
4	Serial output/input (-)
5	Serial output/input (+)
6	N.C.
7	N.C.
8	N.C.

Connector used: RJ-45

Analog communication

Using PE-S7 control unit



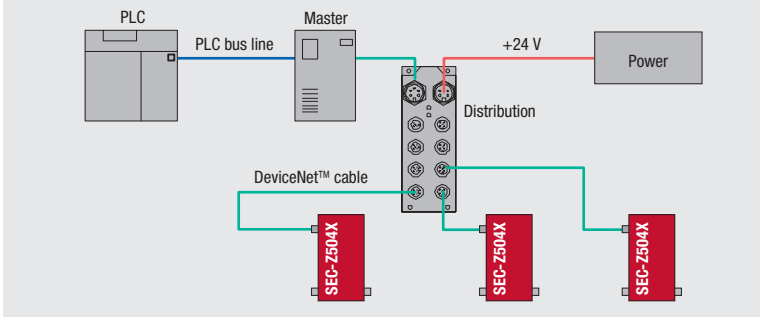
Analog connectors

Pin No.	Signal name	
1	Valve open/closed input	*1
2	Flow rate output signal: 0 to 5 V DC	
3	Power source: +15 V DC	
4	Power source: Common	*2
5	Power source: -15 V DC	
6	Flow rate setting signal: 0 to 5 V DC	
7	Signal: Common	*2
8	Signal: Common	*2
9	NC	

Connector used: D-subminiature 9-contact-pin connector
(with M3 fastening screws)

*1 SEF series is N.C.
*2 The pin No. 4 Common power source and pin No. 7 Common signal are not connected within the mass flow controller. The pin No. 7 and No. 8 Common signals are connected within the mass flow controller.

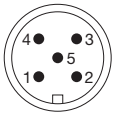
DeviceNet™ communication



DeviceNet™ communications

DeviceNet™ is an open and global field network that was developed by the ODVA (Open DeviceNet™ Vendor Association, Inc.) as a unique means for supporting standardization worldwide. The ODVA offers EDS (Electronic Data Sheet) specifications, which are designed to allow shared operability and programming in a multi-vendor environment. The ODVA also carries out conformance testing. Devices that have passed the ODVA's conformance testing can display the logo.

DeviceNet™ communication connectors

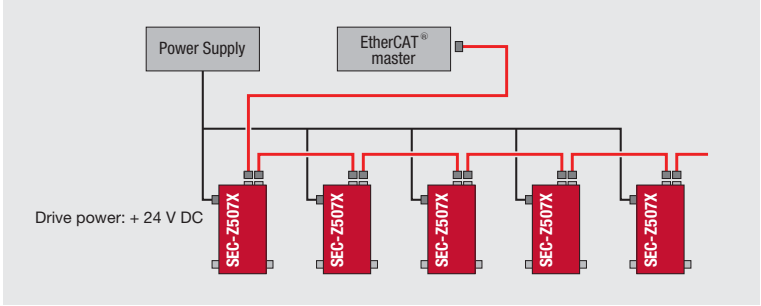


Pin No.	Signal name
1	Drain
2	V+
3	V-
4	CAN_H
5	CAN_L

Advantages

· Reduces costs, since AD/DA converters and I/O boards are not required.
· The user simply connects the devices through network cables and makes address settings. This reduces both the number of processes required and the time involved.
· No special accessories are necessary for the devices. Users can simply choose DeviceNet™ conforming products, which reduces costs.

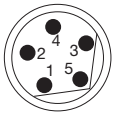
EtherCAT® communication



What is EtherCAT® communication?

Open field bus system based on Ethernet. ETG (EtherCAT® Technology Group) has been established as an international forum to promote support and diffusion of EtherCAT®, and maintain mutual compatibility. ETG specifies functional requirements, conformance tests and its certification procedure, and permits only devices which satisfy conditions specified by ETG to use the EtherCAT logo.

Power connector



Pin No.	Signal name
1	V+
2	N.C.
3	Power Common
4	N.C.
5	N.C.

Connector used: M8 5pin male connector

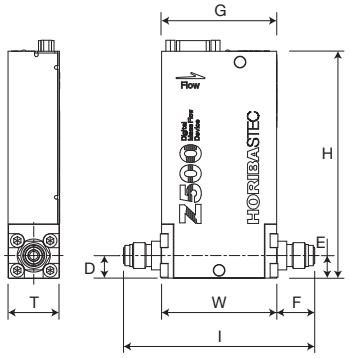
* Use connectors that conform to the EtherCAT® Technology Group standard: ETG5003.2020.

Features

· High bus efficiency and high-speed data scan is realized by simultaneously communicating with many devices.
· The master can use the standard Ethernet interface when connecting to devices, and does not require expensive dedicated hardware.

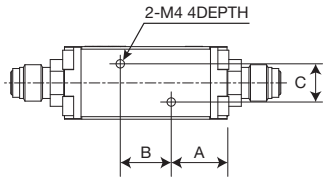
Dimensions

VCR male type

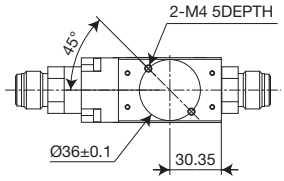


Model	Size	Fittings	H	T	W	I	A	B	C	D	E	F	G
SEC(SEF)-Z512KX	1/4inch	4CRB	126	28.5	63.8	106	21.9	20	15	12.7	12.7	21.1	63.8
SEC(SEF)-Z512(MG)X		4CRL				124							
SEC(SEF)-Z522(MG)XN		4CRE				156				15.3			
SEC(SEF)-Z532MGX(N) SEC(SEF)-Z542MGX(N)	1/2inch	8CRS	139	38.3	70.4	132	Please refer to the bottom view.			18.5	18.5	29	63.8
		8CRJ			82.6	150.4							
		8CRG				177							
SEC(SEF)-Z552MGX SEC(SEF)-Z562MGX		8CRJ	148.5	49	92.4	150.4				22	22	29	78
		8CRG				177							
SEC(SEF)-Z514KX	1/4inch	4CRB	126	28.5	63.8	106	21.9	20	15	12.7	12.7	21.1	63.8
SEC(SEF)-Z514MGX SEC(SEF)-Z524MGXN		4CRL				124							
SEC(SEF)-Z534MGX(N) SEC(SEF)-Z544MGX(N)	1/2inch	8CRS	150	38.3	70.4	132	Please refer to the bottom view.			18.5	18.5	29	63.8
		8CRJ			82.6	150.4							
		8CRG				177							
SEC(SEF)-Z554MGX SEC(SEF)-Z564MGX		8CRJ	158.5	49	92.4	150.4				22	22	29	78
		8CRG				177							
SEC(SEF)-Z517KX SEC(SEF)-Z517MGX SEC(SEF)-Z527MGXN	1/4inch	4CRL	126	28.5	81.8	124	21.9	20	15	12.7	12.7	21.1	80.8
SEC(SEF)-Z537MGX(N) SEC(SEF)-Z547MGX(N)	1/2inch	8CRS	145	38.3	82.6	132	Please refer to the bottom view.			18.5	18.5	29	81.3
		8CRJ				150.4							
SEC(SEF)-Z557MGX SEC(SEF)-Z567MGX		8CRJ	159.3	49	92.4	150.4				22	22	29	85.5

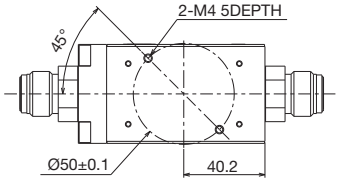
Bottom view



SEC(SEF)-Z51_KX/Z51_(MG)N/Z52_(MG)XN

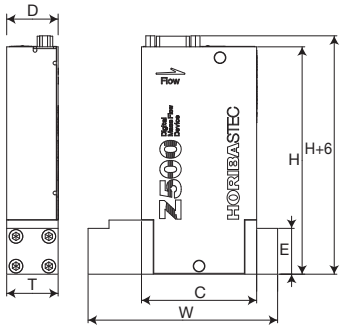


SEC(SEF)-Z53_MGX(N)/Z54_MGX(N)



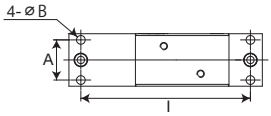
SEC(SEF)-Z55_MGX/Z56_MGX

Surface mount type



Model	Size	Fittings		H	T	W	I	A	B	C	D	E
SEC(SEF)-Z512KX	1.125inch	C-seal	14C3	126	28.5	105	92	21.8	4.75 *1	(63.8)	(28.5)	25.4
SEC(SEF)-Z512(MG)X		W-seal	14W2	126	28.5	93	79.8	21.8	4.4	(63.8)	(28.5)	25.4
SEC(SEF)-Z522(MG)XN			14W3			105	92					
SEC(SEF)-Z512KX	1.5inch	CS-seal	24S2	126	37.6	93	79.8	30	5.5	(63.8)	(28.5)	26
SEC(SEF)-Z512(MG)X												
SEC(SEF)-Z522(MG)X				130	38.6						(38.6)	32.5
SEC(SEF)-Z512KX	1.5inch	W-seal	24W2	130	39	93	79.8	30	5.5	(63.8)	(28.5)	37
SEC(SEF)-Z512(MG)X												
SEC(SEF)-Z522(MG)X											(38.6)	
SEC(SEF)-Z532MGX(N)	1.5inch	C-seal	26C3	139	38.3	107	92	30.2	5.2	(63.8)	(38.3)	31.2
SEC(SEF)-Z542MGX(N)		W-seal	26W3		39	109		28	6.5			37
SEC(SEF)-Z514KX	1.125inch	C-seal	14C3	126	28.5	105	92	21.8	4.75 *2	(63.8)	(28.5)	25.4
SEC(SEF)-Z514MGX		W-seal	14W2	126	28.5	93	79.8	21.8	4.4	(63.8)	(28.5)	25.4
SEC(SEF)-Z524MGXN			14W3			105	92					
SEC(SEF)-Z514KX	1.5inch	W-seal	24W2	130	39	93	79.8	30	5.5	(63.8)	(28.5)	37
SEC(SEF)-Z514MGX												
SEC(SEF)-Z524MGX											(38.6)	
SEC(SEF)-Z534MGX(N)	1.5inch	C-seal	26C3	139	38.3	107	92	30.2	5.2	(63.8)	(38.3)	31.2
SEC(SEF)-Z544MGX(N)		W-seal	26W3		39	109		28	6.5			37
SEC(SEF)-Z517KX	1.125inch	C-seal	14C3	126	28.5	105	92	21.8	4.75 *3	(81.8)	(28.5)	25.4
SEC(SEF)-Z517MGX		W-seal	14W3						4.4			
SEC(SEF)-Z527MGXN												

Bottom view

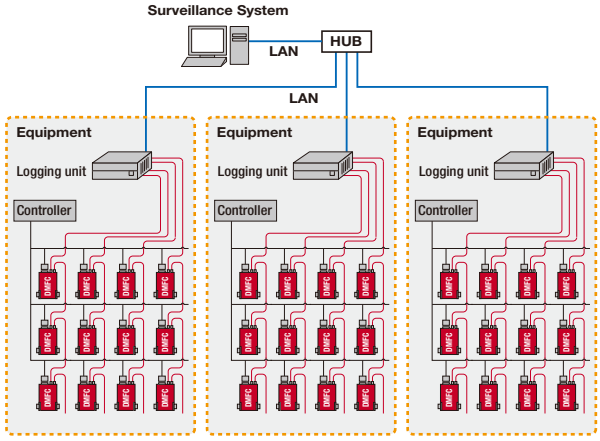


*1:SEC(SEF)-Z522(MG)XN 4.4±0.1
*2:SEC(SEF)-Z524MGXN 4.4±0.1
*3:SEC(SEF)-Z527MGXN 4.4±0.1
Please contact HORIBA other than above table.

eDiagnostic digital mass flow controller monitoring system

The importance of preventative maintenance for production equipment in semiconductor device manufacturing plants is widely acknowledged. In fact, preventative maintenance is considered a critical factor for increasing productivity. HORIBA STEC offers a preventative maintenance system for its mass flow controllers, which are considered key devices in the semiconductor manufacturing process. The mass flow controller's preventative maintenance system monitors the flow rate control conditions and the position of the valve, and determines the status of overall flow rate control in the mass flow controller. The system informs the user of what sort of maintenance is required before the mass flow controller becomes unable to control the flow rate. It is considered difficult to predict the maintenance required for a mass flow controller's functioning by monitoring its flow control status alone. HORIBA STEC's mass flow controller monitoring system collects information on the control status of the digital mass flow controllers (analog control) in semiconductor manufacturing equipment using digital communications, and monitors whether or not there is a need for any preventative maintenance. This system is compatible with LAN (TCP/IP) networks, and a single superior Surveillance Server can be used to monitor the mass flow controllers in each semiconductor manufacturing system. It's also relatively easy to create a wide area network for this monitoring system. The logging unit can be used to log the flow rate control status of digital mass flow controller in each semiconductor manufacturing system. The Surveillance Server is connected to the logging unit through a LAN. The logging unit monitors the flow rate control conditions and the position of the flow control valve, and determines whether any preventative maintenance is necessary. This data can be used to investigate the reasons for problems or to review changes in the gas pressure, in addition to determining whether or not preventative maintenance is required.

Sample system setup



Digital mass flow controller monitoring software; compatible with RS-485 and DeviceNet™ communication

HORIBA STEC also offers monitoring software that is compatible with HORIBA STEC's digital mass flow controller protocol (F-Net protocol) and is able to monitor all mass flow controller related transmissions. This software makes it easy to check the status of transmissions between control units such as the PLC or PC and the SEC-Z500X series units. In addition to checking if the digital transmission cable and signal converter are installed correctly, it can use the digital mass flow controller's address transmissions to monitor and control installation information and valve operating status. When DeviceNet™ transmission is used, the software operates using digital transmission information only. In fact, with DeviceNet™, it is possible to monitor the control status of the digital mass flow controller using just this software, a PC, and the DeviceNet™ transmission unit; there is no need for a special, additional control unit mounted on the equipment.

Easy-to-use digital mass flow controller monitoring software

The digital mass flow controller monitoring system uses eDiagnostic monitoring software. The mass flow controller's control status is monitored through digital transmissions, and then logged and saved in a PC. The eDiagnostic software also features a function that outputs alarms as necessary based on the monitored flow rate control status and valve aperture information. Real-time monitoring makes it possible to go back and review the circumstances surrounding changes in the control status and gas supply conditions. The monitoring information is also extremely useful in investigating the causes of any malfunctions that arise.

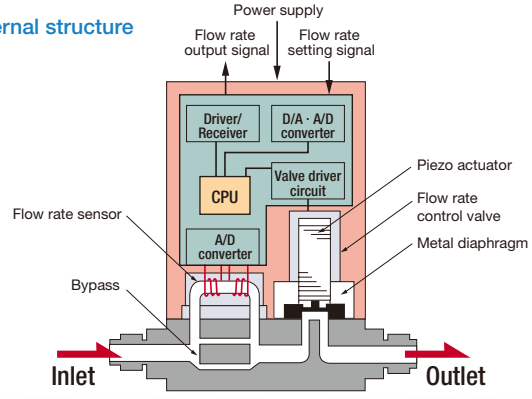
Digital mass flow controller control software

HORIBA STEC also offers control software that is compatible with HORIBA STEC's digital mass flow controller protocol (F-Net protocol). In addition to offering digital mass flow controller flow rate control (step control, loop control functions, etc.), it is also designed to output the aperture control signal for valves mounted on the same gas line. Thanks to these features, this software offers optimal small-scale gas supply system control.

Structure and operating principles

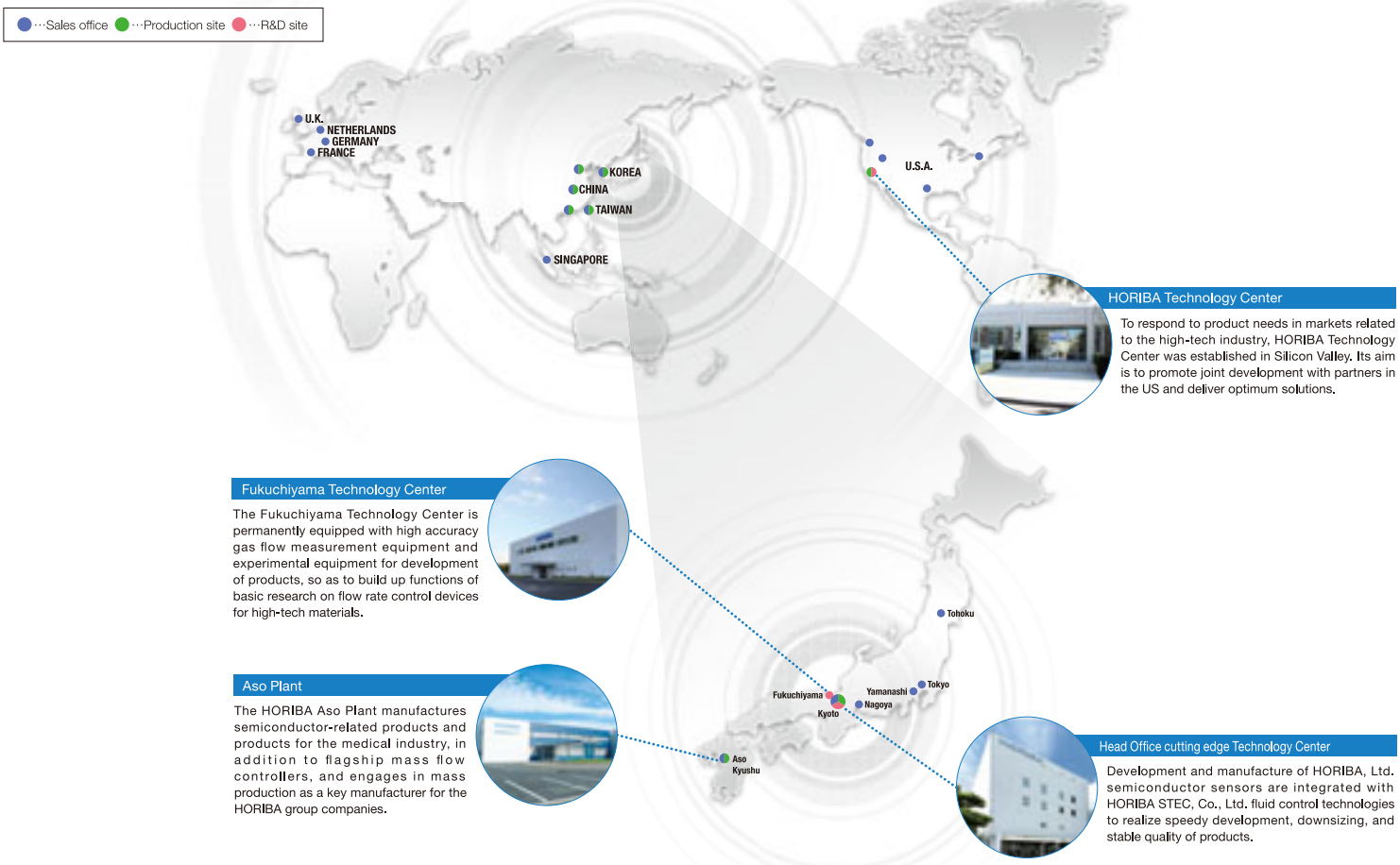
The general structure of the SEC-Z500X series of mass flow controllers is shown in the diagram to the right. These mass flow controllers have a flow rate measurement section that includes a sensor, bypass, flow rate control valve, and special circuitry. A CPU is part of the circuitry, which makes it both multi-functional and highly efficient.
The gas is input from an Inlet joint, and is divided so that it flows over both the flow rate sensor and a bypass. The sensor measures the mass flow rate of the gas, and the flow rate control valve modifies the flow rate so that the difference between the measured flow rate and the flow rate received from the external flow rate setting signal is 0 (zero). The units feature a loop circuit, so even if there is a secondary pressure change or ambient temperature change that could affect the supply pressure of the introduced gas, the flow rate is instantaneously corrected, which ensures stable flow rate control.

Internal structure



Global support

The HORIBA Group's international network ensures complete support for customers.



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High Performance Mass Flow Controller

SEC-Z500X

IMS

The HORIBA Group adopts IMS (Integrated Management System) which integrates Quality Management System ISO9001, Environmental Management System ISO14001, and Occupational Health and Safety Management System OHSAS18001.
We have now integrated Business Continuity Management System ISO22301 in order to provide our products and services in a stable manner, even in emergencies.

RoHS COMPLIANT

Applying to the EU RoHS Directive : This products is compliant with the restriction of the designated 6 hazardous substances(*).
(*) lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE)

Using lead-free soldering : Lead-free soldering is used for mounting components of printed circuit boards.
- Many countries consider the reinforcement of regulations concerning the risk caused by lead to human body and the environment

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Please read the operation manual before using this product to ensure safe and proper handling of the product.

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Printed in Japan 1707SK13